INFLUENCE OF PRE-SLAUGHTER HOLDING ON THE BACTERIAL QUALITY OF MARKET HOGS AND CARCASSES

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Introduction

During the slaughtering process, if animal's intestinal tracts contain heavy loads of ingesta, not only are they more difficult to handle during evisceration, but also more likely to be accidentally cut, thus contaminating the carcass. Therefore, for sanitary reasons, in modern slaughtering facilities, hogs are normally held off feed for 16 to 24 hours prior to slaughter. During preslaughter holding, water supplying and resting also reduce animal stress. Properly cleaning of the hogs at holding pens during this period of time can also reduce contamination. Several studies have investigated preslaughter holding treatment effects on the animal and carcass quality (Stalder *et al.*, 1998; Hurd *et al.*, 2001; Hurd *et al.*, 2002). The objective of this study was to investigate the influence of preslaughter holing on the bacterial qualities of the surfaces of pigs and carcasses.

Materials and Methods

Pigs were slaughtered at market weight (approximate 100±20 kg) in 4 abattoirs in Taiwan. In this study, "before preslaughter holding" referred to the time when hogs arrived at the abattoirs, which was about 6-7 pm; "after preslaughter holding" referred to the time when pigs were held for approximate 12 hour and right before being slaughtered; "after slaughtering" referred to the time, after slaughtering and right before the final carcass washing. Swab samples of 100 cm^2 were collected from surfaces on the pigs or carcasses at the location on the belly side 10 cm below central back lines. Each swab was stomached with 10 ml of 0.1% w/v peptone water. Serial dilutions were then made with 0.1% peptone as the diluents, and 1 ml portions of each homogenate were added and mixed with the selected pre-autoclaved melt agar on duplicate plates. The plates were incubated, and the plates evaluated for total plate counts, *Pseudomonas*, *Listeria*, *Enterococcus*, *Bacillus cereus*, *Staphylococcus aureus*, *Salmonella* and *Escherichia coli* which were enumerated and identified accordingly. Microbial counts in this study were expressed as $\log_{10}$ CFU per cm^2 of swabbed area. Data were analyzed using the SAS software.

Results and Discussion

In Taiwan, there are two major ways of dealing with hogs after auction. In this study, hogs in the "meat market slaughter plant" were first moved to holding pens at the meat market slaughter plant, washed, rested, held, and then slaughtered; hogs going to "abattoirs A, B, or C" were first mixed after auction, transported to the appropriate abattoir to be held, washed, rested, and then slaughtered. It was found that the microbial counts including total plate, *Pseudomonas*, *Enterococcus*, *Bacillus cereus*, *S. aureus*, *Salmonella* and *E. coli* on the surfaces of hog in abattoir A before preslaughter-holding were significantly higher than those at the other three abattoirs (Table 1). After approximately 12 hrs holding, the microbial counts on the surfaces of hogs in abattoir A were still higher than those of the hogs in other abattoirs (Table 2).

After slaughter by common commercial procedures, the microbial counts detected on the carcass surfaces decreased probably due to scalding and dehairing. In addition, most of the microbial counts on the surfaces of the carcasses slaughtered at abattoir A were still significantly higher than those in other abattoirs (Table 3). Mixing animals during holding could contribute more stress. Hurd *et al.* (2002) stated that rapid infection during transportation and during holding was a major cause of increased *Salmonella* prevalence in swine and suggested that holding pen should be chosen as an important control point for *Salmonella*. Also, in this study, a non-functionally water spraying and cleaning system in abattoir A, thus led to non-thoroughly and not-effectively washing and cleaning might be the major reason which led to higher microbial counts detected on the surfaces of hogs in abattoir A. It was also observed that the hog-driving workers in these abattoirs also helped in other tasks such as dehairing, eviscerating, and etc. due to lack of sufficient labors, thus led to higher likelihood of cross-contamination of carcasses.

Table 1: Microbial quality of pig surfaces before preslaughter-holding.

Location / Microorganisms	Meat market slaughtering plant (n=54)	Abattoir A (n=71)	Abattoir B (n=71)	Abattoir C (n=71)
		log CFU/cm^2		
Total plate count	5.99^{b} ± 0.83	6.48^{a} ± 1.49	5.34^{c} ± 0.70	5.54^{c} ± 1.03
Pseudomonas	6.00^{a} ± 1.17	5.78^{ab} ± 1.08	4.65^{c} ± 1.21	5.54^{b} ± 0.96
Listeria	4.85^{a} ± 0.76	4.19^{b} ± 0.57	3.91^{c} ± 0.66	4.15^{b} ± 0.76
Enterococcus	4.08^{b} ± 1.39	4.62^{a} ± 0.70	4.14^{b} ± 0.52	3.75^{c} ± 1.00
Bacillus cereus	5.54^{b} ± 1.53	6.94^{a} ± 0.84	5.28^{b} ± 1.84	5.56^{b} ± 1.26
Staphylococcus	5.68^{b} ± 1.28	6.39^{a} ± 1.37	5.20^{b} ± 1.23	5.16^{b} ± 2.24
E. coli	1.50^{b} ± 0.77	2.02^{a} ± 0.87	1.57^{b} ± 0.85	1.44^{b} ± 0.93

$^{a-c}$ Means within a row that have different superscript are significantly different ($p<0.05$).

Table 2: Microbial quality of pig surfaces after preslaughter-holding.

Location / Microorganisms	Meat market slaughtering plant (n=60)	Abattoir A (n=72)	Abattoir B (n=72)	Abattoir C (n=72)
		log CFU/cm^2		
Total plate count	5.67^{b} ± 1.66	7.06^{a} ± 1.27	5.71^{b} ± 1.08	5.99^{b} ± 1.06
Pseudomonas	5.05^{c} ± 1.10	6.07^{a} ± 0.05	5.54^{b} ± 1.08	6.01^{a} ± 0.77
Listeria	4.51^{c} ± 0.65	5.07^{a} ± 0.70	4.67^{bc} ± 0.75	4.86^{b} ± 0.69
Enterococcus	4.13^{c} ± 1.48	4.78^{a} ± 0.57	4.23^{b} ± 0.46	4.40^{b} ± 0.93
Bacillus cereus	5.61^{b} ± 1.23	6.31^{a} ± 1.54	5.69^{b} ± 2.07	6.71^{a} ± 0.79
Staphylococcus	5.52^{c} ± 1.04	6.67^{a} ± 1.02	5.56^{c} ± 1.35	6.24^{b} ± 0.70
E. coli	1.18^{c} ± 0.90	2.28^{a} ± 0.99	1.77^{b} ± 0.71	1.96^{b} ± 0.87

$^{a-c}$ Means within a row that have different superscript are significantly different ($p<0.05$).

Table 3: Microbial quality of carcass surfaces after slaughtering.

Location / Microorganisms	Meat market slaughtering plant (n=60)	Abattoir A (n=72)	Abattoir B (n=72)	Abattoir C (n=72)
		log CFU/cm^2		
Total plate count	1.76^{c} ± 1.81	3.84^{a} ± 1.05	2.39^{b} ± 0.74	2.49^{b} ± 1.39
Pseudomonas	4.84^{a} ± 1.41	3.49^{b} ± 0.88	1.72^{c} ± 0.83	2.03^{c} ± 1.00
Listeria	1.67^{b} ± 0.76	2.63^{a} ± 0.99	1.51^{b} ± 0.61	1.66^{b} ± 1.11
Enterococcus	0.92^{b} ± 0.51	2.80^{a} ± 0.82	2.08^{b} ± 1.57	0.72^{c} ± 0.65
Bacillus cereus	3.35^{b} ± 0.68	3.67^{a} ± 1.35	2.55^{b} ± 1.10	2.51^{b} ± 0.87
Staphylococcus	1.61^{a} ± 1.32	1.54^{a} ± 0.91	1.11^{b} ± 0.79	0.80^{b} ± 0.93
E. coli	2.13^{a} ± 1.45	1.15^{b} ± 0.83	0.96^{b} ± 0.76	1.02^{b} ± 1.05

$^{a-c}$ Means within a row that have different superscript are significantly different ($p<0.05$).

Conclusions

In conclusion, preslaughter holding affected the microbial qualities of market hogs and carcasses. Moreover, proper handling during holding, and cleaning, transport, skinning and prevention of cross-contamination could lead to a decrease in microorganisms detected on carcasses.

References

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